We claim:

1. A method for processing a received, modulated pulse that requires predictive deconvolution to resolve a scatterer from noise and other scatterers, comprising:

a) receiving a return signal;

b) obtaining $L+(2M-1)(N-1)$ samples y of the return signal, where $y(\ell)=\tilde{\mathbf{x}}^T(\ell)\,\mathbf{s}+v(\ell)$;

c) applying RMMSE estimation to each successive N samples to obtain initial impulse response estimates $[\hat{x}_1\{-(M-1)(N-1)\},\cdots,\hat{x}_1\{-1\},\hat{x}_1\{0\},\cdots,\hat{x}_1\{L-1\},\hat{x}_1\{L\},\cdots,\hat{x}_1\{L-1+(M-1)(N-1)\}]$;

d) computing power estimates $\hat{\rho}_1(\ell)=|\hat{x}_1(\ell)|^2$ for $\ell=-(M-1)(N-1),\cdots,L-1+(M-1)(N-1)$;

(e) computing MMSE filters according to $\mathbf{w}(\ell)=\rho(\ell)\,(\mathbf{C}(\ell)+\mathbf{R})^{-1}\mathbf{s}$, where $\rho(\ell)=|x(\ell)|^2$ is the power of $x(\ell)$, and $\mathbf{R}=E[\mathbf{v}(\ell)\,\mathbf{v}^H(\ell)]$ is the noise covariance matrix;

(f) applying the MMSE filters to y to obtain $[\hat{x}_2\{-(M-2)(N-1)\},\cdots,\hat{x}_2\{-1\},\hat{x}_2\{0\},\cdots,\hat{x}_2\{L-1\},\hat{x}_2\{L\},\cdots,\hat{x}_2\{L-1+(M-2)(N-1)\}]$; and

(g) repeating (d)-(f) for subsequent reiterative stages until a desired length-L range window is reached, thereby resolving the scatterer from noise and other scatterers.

2. A method as in claim 1, wherein the RMMSE estimation is performed with a plurality of parallel processors.

3.A method as in claim 1, further comprising setting a nominal level for which the power estimates are not allowed to fall below.

4. A method as in claim 1, wherein the y samples are obtained via A/D conversion.

5. A method as in claim 1, wherein the method is applied in range profiling.

6. A method as in claim 1, wherein the method is applied in a weather radar system.

7. A method as in claim 1, wherein the method is applied in image recognition for Synthetic Aperture Radar (SAR).

8. A method as in claim 1, wherein the method is applied in image recognition for Inverse SAR (ISAR).

9. A method as in claim 1, wherein the method is applied in remote sensing.

10. A method as in claim 1, wherein the method is applied in ultrasonic non-destructive evaluation for structural integrity.

11. A method as in claim 1, wherein the method is applied in seismic estimation.

12. A method as in claim 1, wherein the method is applied in biomedical imaging.

13. A method as in claim 1, wherein the method is applied in inverse filtering of optical images.

14. A radar receiver system, comprising:
a receiver;
a processor including a Reiterative Minimum Mean-Square Error estimation (RMMSE) radar pulse compression algorithm; and
a target detector.

15. A radar receiver system as in claim 14, wherein the RMSSE radar pulse compression algorithm comprises:

(a) obtaining $L+(2M-1)(N-1)$ samples y of a radar return signal, where $y(\ell)=\tilde{\mathbf{x}}^{T}(\ell)\,\mathbf{s}+v(\ell)$;

(b) applying RMMSE pulse compression to each set of N contiguous samples to obtain initial radar impulse response estimates
$[\hat{x}_1\{-(M-1)(N-1)\},\cdots,\hat{x}_1\{-1\},\hat{x}_1\{0\},\cdots,\hat{x}_1\{L-1\},\hat{x}_1\{L\},\cdots,\hat{x}_1\{L-1+(M-1)(N-1)\}]$;

(c) computing power estimates $\hat{\rho}_1(\ell)=|\hat{x}_1(\ell)|^2$ for $\ell=-(M-1)(N-1),\cdots,L-1+(M-1)(N-1)$;

(d) computing range-dependent filters according to $\mathbf{w}(\ell)=\rho(\ell)\,(\mathbf{C}(\ell)+\mathbf{R})^{-1}\mathbf{s}$, where $\rho(\ell)=|x(\ell)|^2$ is the power of $x(\ell)$, and $\mathbf{R}=E[\mathbf{v}(\ell)\,\mathbf{v}^{H}(\ell)]$ is the noise covariance matrix;

(e) applying the range-dependent filters to y to obtain
$[\hat{x}_2\{-(M-2)(N-1)\},\cdots,\hat{x}_2\{-1\},\hat{x}_2\{0\},\cdots,\hat{x}_2\{L-1\},\hat{x}_2\{L\},\cdots,\hat{x}_2\{L-1+(M-2)(N-1)\}]$; and

(f) repeating (c)-(e) for subsequent reiterative stages until a desired length-L range window is reached.

16. A radar receiver system as in claim 14, further comprising a plurality of parallel processors for performing the RMMSE pulse compression.

17. A radar receiver system as in claim 14, wherein a nominal level is set for which the power estimates are not allowed to fall below.

18. A radar receiver system as in claim 14, further comprising an analog-to-digital (A/D) converter.

19. A radar receiver system as in claim 15, further comprising an analog-to-digital (A/D) converter for obtaining the y samples.

20. A radar receiver system as in claim 14, wherein the system is an airport radar system.

21. A radar receiver system as in claim 14, wherein the system is a weather radar system.

22. A method for processing a received, modulated radar pulse to resolve a radar target from noise or other targets , comprising:

a) receiving a radar return signal;

b) obtaining $L+(2M-1)(N-1)$ samples y of the radar return signal, where $y(\ell)=\tilde{\mathbf{x}}^T(\ell)\,\mathbf{s}+v(\ell)$;

c) applying RMMSE pulse compression to each successive N samples to obtain initial radar impulse response estimates $[\hat{x}_1\{-(M-1)(N-1)\},\cdots,\hat{x}_1\{-1\},\hat{x}_1\{0\},\cdots,\hat{x}_1\{L-1\},\hat{x}_1\{L\},\cdots,\hat{x}_1\{L-1+(M-1)(N-1)\}]$;

d) computing power estimates $\hat{\rho}_1(\ell)=|\hat{x}_1(\ell)|^2$ for $\ell=-(M-1)(N-1),\cdots,L-1+(M-1)(N-1)$;

(e) computing range-dependent filters according to $\mathbf{w}(\ell)=\rho(\ell)\,(\mathbf{C}(\ell)+\mathbf{R})^{-1}\,\mathbf{s}$, where $\rho(\ell)=|x(\ell)|^2$ is the power of $x(\ell)$, and $\mathbf{R}=E[\mathbf{v}(\ell)\ \mathbf{v}^H(\ell)]$ is the noise covariance matrix;

(f) applying the range-dependent filters to y to obtain $[\hat{x}_2\{-(M-2)(N-1)\},\cdots,\hat{x}_2\{-1\},\hat{x}_2\{0\},\cdots,\hat{x}_2\{L-1\},\hat{x}_2\{L\},\cdots,\hat{x}_2\{L-1+(M-2)(N-1)\}]$; and

(g) repeating (d)-(f) for subsequent reiterative stages until a desired length-L range window is reached, thereby resolving the radar target from noise or other targets.

23. A method as in claim 22, wherein the RMMSE pulse compression is performed with a plurality of parallel processors.

24. A method as in claim 22, wherein the y samples of the radar return signal are obtained via A/D conversion.

25. A method as in claim 22, further comprising setting a nominal level for which the power estimates are not allowed to fall below.

26. A method as in claim 22, wherein the method is applied in an airport radar system.

27. A method as in claim 22, wherein the method is applied in a weather radar system.

28. A method as in claim 22, wherein the y samples of the radar return signal are obtained via A/D conversion.

29. A method as in claim 22, wherein a plurality of radar targets are resolved and separately identified.